

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号
特開2001-137747
(P2001-137747A)

(43) 公開日 平成13年5月22日 (2001.5.22)

(51) Int.Cl.⁷

B 0 5 B 7/08
1/26

識別記号

F I

B 0 5 B 7/08
1/26

データベース* (参考)

4 F 0 3 3

A

審査請求 未請求 請求項の数 5 O L (全 9 頁)

(21) 出願番号 特願平11-326661

(22) 出願日 平成11年11月17日 (1999. 11. 17)

(71) 出願人 390002277

間藤 公利

静岡県駿東郡長泉町東野606番地の6

(72) 発明者 間藤 公利

静岡県駿東郡長泉町東野606番地の6

(74) 代理人 10008/826

弁理士 八木 秀人 (外1名)

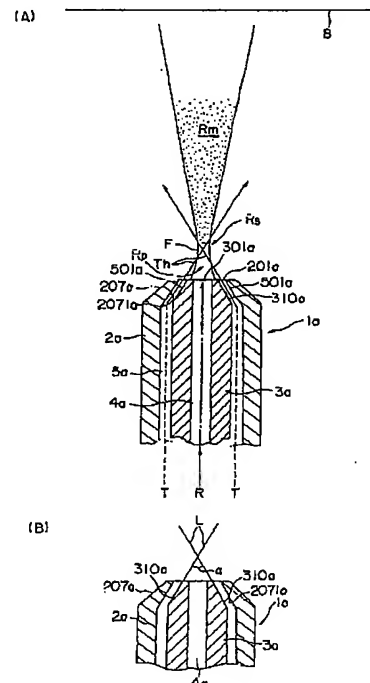
Fターム (参考) 4F033 AA01 BA01 BA03 CA01 DA01
EA01 JA08 NA01

(54) 【発明の名称】 微粒化ノズル

(57) 【要約】

【課題】 極めて簡易な構造で、微粒化特性に優れた微粒化ノズルの提供。

【解決手段】 ノズル内部に導入された気体Tを外部に高速気流Thとして噴出して、前記ノズル1 (1a、1b) から吐出される液体Rを外部混合により微粒化する微粒化ノズル1 (1a、1b) において、前記高速気流Thを、前記ノズル1 (1a、1b) に設けられた気体噴射口201 (201a、201b) の前方位置に焦点Fを結ぶ先細り円錐状に前記気体噴射口201 (201a、201b) から噴出する構成とし、前記ノズル1 (1a、1b) に形成された液体噴出口301 (301a、301b) から吐出されてくる液体Rを、前記焦点位置F領域で、前記高速気流Thにより瞬間的に液柱中心に及ぶまで粉碎して微粒化する。



갑제 7 호증

【特許請求の範囲】

【請求項1】 ノズルボディ内部に導入された液体を吐出するとともに、同ノズルボディ内部に導入された気体を高速気流として噴射することにより、前記液体を外部混合により微粒化するノズルにおいて、

前記高速気流は、前記ノズルボディに設けられた気体噴射口の前方位置に焦点を結ぶ先細り円錐状に前記気体噴射口から噴射される構成であって、

前記焦点領域で、前記気体噴射口の内側に設けられた液体噴出口から噴出されて液柱を形成する液体を、前記高速気流によって前記液柱中心に及ぶまで粉碎して微粒化することを特徴とする微粒化ノズル。

【請求項2】 前記ノズルは、ノズル内部に気体を導入する気体導入口と、該気体導入口から導入された気体を外部に噴射する前記気体噴射口と、を備えた中空形状の前記ノズルボディと、ノズル内部に導入された液体の通過路を形成する液体通路管と、該液体通路管の先端部に開口して、前記気体噴射口に臨むように配置される液体噴出口と、を備え、前記ノズルボディ内部に挿着される中子様の部材であって、前記ノズルボディ内側に前記気体導入口及び前記気体噴射口と連通する気体通路領域を形成するとともに、前記ノズルボディの先細り尖頭部の内側領域に、該尖頭部内壁と協働して、前記気体噴射口から前記焦点に向かって噴射される高速気流を形成する液体通路部材と、を備えたことを特徴とする請求項1記載の微粒化ノズル。

【請求項3】 前記ノズルボディの前記尖頭部内壁は、下流側方向に先細りするように形成されるとともに、前記気体噴射口に臨む前記液体噴出口の先端部の外周壁は、下流側方向に先細りするように形成されたことを特徴とする請求項2記載の微粒化ノズル。

【請求項4】 前記液体通路部材の前記液体噴出口のやや下方位置には、前記ノズルボディの尖頭部内壁に当接するリング部が形成され、該リング部には、前記気体通路領域を進行してきた空気を通過させて整流高速化し、前記気体噴射口から吐出される高速気流を形成するための高速気流形成溝が、周方向等間隔に複数形成された構成であって、前記高速気流形成溝は、ノズル中心方向から放射状に形成されたことを特徴とする請求項3記載の微粒化ノズル。

【請求項5】 前記液体噴出口の内口径を直径2mm以上に形成した場合において、粒径5 μ m以下の液体微粒子を形成できることを特徴とする請求項1から4のいずれかに記載されたことを特徴とする微粒化ノズル。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、液体を外部混合方式で微粒化するノズルに関し、更に詳細には、ノズルか

ら吐出されて液柱を形成する液体を、ノズルから吐出されてノズル前方位置に焦点を結ぶ先細り円錐状の高速気流によって前記液柱の中心部まで破碎し、微粒化するノズルに関する。

【0002】

【従来の技術】液体を微粒化して噴霧吐出する微粒化ノズルは、塗装、造粒、燃焼、窯業における釉薬吹き付け、製紙、繊維生産工程の加湿作業、薄膜精密コーティング等の多種多様な産業分野で、利用されている。

【0003】典型的な従来技術を、簡略化して示す図9を参照して説明する。ノズルボディ18内部の中心領域に配置された液体通路管19の液体吐出口13から液体rをノズル20の前方に吐出するとともに、この吐出液体r₁の外周領域に対して、ノズル20内部に形成された気体通路16に導入された気流tを、ノズルボディ18の尖頭部14に形成された気体噴射口12から前方に吐出する構成によって、液体rを微粒化液体r_mに変換する外部混合方式の微粒化ノズル20がある。

【0004】

【発明が解決しようとする課題】しかしながら、上記従来技術では、ノズル20からノズル20前方に吐出された直後の気流の初速度v₀は、前方（下流側）に行くにつれて分散傾向となり、風速も気流断面積の増加に伴い急激に減衰（v₀→v₁→v₂）していくことになる（図9の風速変化を簡易に示すグラフ参照）。このため、吐出気流thの液体を破碎する力は、急速に弱まって行くことになる。

【0005】また、ノズル20では、気体噴出口15の構成が、符号15で示すように直線状に形成されているため、ノズル20から吐出される液体rは、ノズル20前方の液体rと気流thの境界層Lにおいて、徐々に微粒化されていく構成となっている。このため、ノズル20の前方には、所定長の液柱（微粒化されない液体部分）r₁を残してしまうことになる。

【0006】その結果、ノズル20の先端から符号d1、d2で示す位置に、噴霧面17がある場合においては、噴霧された微粒化液体r₃、r₅の中心部分に、液柱r₁の存在によって微粒化不十分な液体r₂、r₄が相当量噴霧されてしまい、噴霧面17が所定距離にある場合であっても、図9左側の粒径分布のグラフに示すように、噴霧領域の中央には粒径の大きな液体が噴霧されてしまうという不具合が発生し、精密かつ高度な微粒化を達成できないという技術的課題があった。

【0007】これに加え、液柱r₁による影響を極力回避して所望の液体微粒化を達成するためには、液体噴出口13の口径をできるだけ小さくしなければならない、というノズル設計上の不可避的な制限もあった。具体的には、水を平均粒径5 μ m程度にまで微粒化するためには、液体噴射口13の内口径wを0.3～0.5mm程度にしなければならなかった。

【0008】このように、液体噴射口13の内口径を小さくする設計が採用されたノズルの場合では、目詰まりを起こしやすく、また粘度のより大きな液体では、より大きな圧力で噴出する必要があることから、作業上の制限が多く、不便であった。

【0009】一方、近年、微粒化ノズルには、精密かつ均一に、所望の粒径の超微粒子を得ることができるといふ高度の性能が要求され、特に、近年成長著しい磁気ディスクの薄膜精密コーティングや半導体製造業などの分野では、その要求精度は益々高いものとなっている。

【0010】そこで、本発明の目的は、極めて簡易な構造で、微粒化特性に優れた微粒化ノズルを提供することにある。

【0011】

【課題を解決するための手段】上記目的を達成するために、請求項1では、ノズルボディ内部に導入された液体を吐出するとともに、同ノズルボディ内部に導入された気体を高速気流として噴射することにより、前記液体を外部混合により微粒化するノズルにおいて以下の手段を採用する。即ち、前記高速気流を、前記ノズルボディに設けられた気体噴射口の前方位位置に焦点を結ぶ先細り円錐状に前記気体噴射口から噴射される構成として、前記焦点領域で、前記気体噴射口の内側に設けられた液体噴出口から噴出されて液柱を形成する液体を、前記高速気流によって前記液柱の中心に及ぶまで粉碎して微粒化するこの手段では、微粒化ノズルの気体噴射口から噴射吐出される高速気流が、この気体噴射口に近接する位置に焦点を結ぶ先細り円錐状に噴射されるように構成されているため、前記焦点領域で気流の破砕力が集中し、液体は瞬間的に均一に破砕されて、超微粒化されることになる。即ち、微粒化ノズルの気体噴射口から噴出される高速気流は、気体噴射口からやや離れた下流側に形成される焦点領域で、強制的により「縮流」される状態とされ、高速気流の断面積が、気体噴射口の面積よりも小さくされるため、該焦点位置で流速が最大となって、強い破砕力が得られる。尚、「縮流」とは、流体がオリフィスや容器の壁に開いた小さい孔から噴流となって吐出する場合に、吐出口から少し離れた下流位置で噴流の断面積が吐出部の面積よりも小さくなる現象をいう。

【0012】請求項2では、前記ノズルを、別体で形成された二つの部材(1)、(2)で構成する。具体的には、(1)ノズル内部に気体を導入する気体導入口と、該気体導入口から導入された気体を外部に噴射する前記気体噴射口と、を備えた中空形状の前記「ノズルボディ」と、(2)ノズル内部に導入された液体の通過路を形成する液体通路管と、該液体通路管の先端部に開口して、前記気体噴射口に臨むように配置される液体噴出口と、を備え、前記ノズルボディ内部に挿着される中子様の部材であって、前記ノズルボディ内側に前記気体導入口及び前記気体噴射口と連通する気体通路領域を形成す

るとともに、前記ノズルボディの先細り尖頭部の内側領域に、該尖頭部内壁と協働して、前記気体噴射口から前記焦点に向かって噴射される高速気流を形成する「液体通路部材」である。この手段では、微粒化ノズルを中空のノズルボディと、該ノズルボディに挿着される中子様の液体通路部材と、の二つの部材からなる簡易な構成によっても、気体噴射口の前方位位置に焦点を結ぶ先細り円錐状の高速気流が、吐出された液体の液柱中心部に及ぶように形成することができる。

【0013】請求項3では、請求項2記載の微粒化ノズルにおいて、ノズルボディの尖頭部内壁を、下流側方向に先細りするように形成されるとともに、ノズルボディの気体噴射口に臨む液体噴出口の先端部外周壁を、下流側方向に先細りするように形成する。この手段では、下流側方向(気体(液体)吐出方向)に先細りする、ノズルボディ尖頭部内壁と液体噴出口の先端部外周壁を、整流板として作用させることによって、ノズルボディ内部に形成された請求項2記載の気体通路領域を直進して来る気体を、気体噴射口の前方位位置に焦点を結ぶ先細り円錐状の気流に変換して気体噴射口から噴射吐出する。

【0014】請求項4では、請求項3記載の微粒化ノズルにおいて、液体通路部材の液体噴出口のやや下方位置部分に、ノズルボディの尖頭部内壁に当接するリング部を形成し、該リング部には、気体通路領域を進行してきた気体を通過させて整流高速化し、気体噴射口から吐出する高速気流を形成するための高速気流形成溝を、周方向等間隔に、ノズル中心方向から放射状に複数形成する。この手段では、気体通路領域の前方に栓をするように、ノズルボディの尖頭部内壁に当接して配置リング部に形成された高速気流形成溝は、気体通路領域を進行してきた気流を狭小な通路に追い込んで、気流を高速化するとともに、前方方向に整流する作用を発揮する。

【0015】請求項5では、請求項1から4のいずれかに記載された液体噴出口の内口径を直径2mm以上に形成した場合においても、粒径5 μ m以下の液体微粒子を形成できる。この手段では、液体噴出口の内口径を大きく設計できるので、目詰まりを防止することができるだけでなく、粘度の大きい液体であっても低圧で吐出することが可能となる。

【0016】以上のような手段を採用することにより、本発明は、簡易な構成でありながら、微粒化特性に優れた微粒化ノズルを提供できるようになる。即ち、本発明に係る微粒化ノズルは簡易な構成であることから、ノズルのサイズも可変しやすく、かつ、微粒化調整も容易なため、種々の産業分野に対して、生産工程の効率化や自動化、製品の向上などの面で役立つ、より精密な液体微粒化技術を提供できるようになるという技術上の意義を有する。

【0017】

【発明の実施の形態】次に、本発明の好適な実施形態に

ついて、添付図面を参照しながら説明する。図1(A)は、本発明に係る微粒化ノズルの好適な実施形態の要部を簡略化して表す断面図、同図(B)は、同微粒化ノズルの尖頭部の拡大断面図、図2は、同ノズルの実施例の外観構成を示す斜視図、図3は、同実施例の構成部品を分解して示す図、図4(A)は、同実施例の構成部品である液体通路部材の先端部分を拡大して示す斜視図、(B)は、同先端部分を真上から見た平面図、図5(A)は、同実施例の内部構成を示す縦断面図、同図(B)は、同実施例の尖頭部の拡大断面図、図6は、同実施例による液体の微粒化状態を簡易に表す図、図7は、実施例である微粒化ノズルを使用して、液体流量別の50%粒径を測定した結果をグラフに表した図、図8は、液体R、気体Tのそれぞれをノズル1bに送り込む場合の実施形態を簡略化して示す図、である。

【0018】まず、図1を参照して、本発明の好適な実施形態である微粒化ノズル1aの要部構成を、簡略化して説明する。微粒化ノズル1aは、(1)気体噴射口201aを先端部に備え、ノズル外筒部を構成する中空のノズルボディ2aと、(2)符号4aに示す液体通路に連通する液体噴出口301aを先端部に備え、該液体噴出口301aを前記気体噴射口201aに臨むように前記ノズルボディ2a内部に挿着される液体通路部材3aと、から構成されており、ノズルボディ2aと液体通路部材3aによって形成される内部空間5aは、ノズル1aに導入される気体Tの通路(以下「気体通路」という。)となっている。

【0019】ノズルボディ2aの尖頭部207aは、前方方向(下流側)に先細り形状とされている。この尖頭部207aの尖頭部内壁2071aと液体通路部材3aの尖頭部310aの外壁面によって形成され、斜め前方ノズル中央に向けて傾斜された気体吐出路501aの口径は、気体通路5aの口径よりも小さく設計されている。

【0020】このため、気体通路5aを直進してきた気体Tは、狭小な気体吐出路501aを通過する過程で高速化されるとともに方向変換されて、ノズル1a前方に先細り円錐形状に吐出される高速気流Thを形成する。

【0021】この高速気流Thの内側領域からは、液体噴出口301aから所定流量で液体Rが吐出される。この吐出された液体Rは、液体噴出口301aから少し離れた下流側の位置で、流体特有の特性により断面積最小の縮流部Rsを形成する。

【0022】この縮流部Rs領域に重なるように、上記高速気流Thは、断面積最小、風速最大の縮流部を構成する焦点Fを形成する。これにより、高速気流Thは、この焦点F位置で瞬間的に液体Rを破碎し、微粒化液体Rmを所望の噴霧面8に噴霧できるようにする。

【0023】この焦点F位置では、高速気流Thの風速は最大となるので、液体Rと高速気流Thの境界層にお

いては、液体破碎力は極大となって、液体Rの超微粒化が、効率良くかつ確実に達成されることになる。即ち、高速気流Thは、ノズル1aから吐出された液体Rが形成する液柱Rpの中心部にまで及んで破碎するため、破碎されない液体Rを最小限に止めることができる。

【0024】ここで、液体噴出口301aを形成する液体通路部材3aの傾斜尖頭部310aの傾斜角度は、その前方延長線L(図1(B)参照)が交わったときの角度 α が $60^{\circ} \sim 90^{\circ}$ になるように設計するのが望ましい。これは、高速気流Thの噴射角度が、鈍角すぎても鋭角すぎても、所望する微粒化効果が得られにくいからである。

【0025】以下、図2を参照して、本発明に係る微粒化ノズルの具体的な実施例の構成について、説明する。まず、本実施例であるノズル1bの外観は、略円筒形状のノズル外筒部を構成する中空のノズルボディ2bと、該ノズルボディ2bの中空部分に挿着されて、ノズルボディ2b下端部にナット部306を露出させている液体通路部材3bと、から構成されている。

【0026】ここで、ノズルボディ2bは、外観上、次の(1)～(5)の部分から構成されている。即ち、

- (1) 該ノズルボディ2bの前端部に形成され、その外周部分に雄ネジ209形成された細筒部206と、
- (2) この細筒部206の先端に形成された、ノズル中心X方向に傾斜する先細り尖頭部207bと、(3) この尖頭部207bの先端に開口する気体噴射口201bと、(4) 該ボディ2bの外周部分を垂直方向に切り抜いて、その内周面に雌ネジ203が形成され、気体噴射口201bに連通する気体導入口202と、(5) ノズルボディ2bの外周部分に対向形成された一対の凹状平坦部204と、から構成されている。

【0027】尚、前記細筒部206の雄ネジ209部には、雄ネジ部601が内周部に形成された孔602を備える六角ナット6が、螺着されている。また、上記凹状平坦部204は、ノズル1bをスパナ等の把持部材で挟んで、周辺部材に固定し易くして、ノズルの組立てを容易化したり等するために設けられた部位である。

【0028】図3は、このノズル1bを構成する部材を分解して示している。上記ノズル1bは、上述したノズルボディ2bと、該ノズルボディ1bの細筒部206に螺着されるナット6(上述)と、ノズルボディ1b内部に挿着され、微粒化対象の液体Rの通路を形成する中子様の液体通路部材3bと、気体密閉用のパッキン(リング)7と、から構成されている。

【0029】ここで、液体通路部材3bの外観構成を、図3、図4に基づいて説明する。まず、液体通路部材3bは、次の(1)～(7)で構成されている。即ち、

- (1) 内側に液体Rの通路4b(図5参照)を備える円筒状の管部303と、(2) この管部303の上端に開口形成されて、液体Rを外部に吐出する液体噴出口30

1bと、(3) 管部303の先端やや下方部分310bに、周方向にリング状に突設され、前記ノズルボディ2bの尖頭部内壁2071b(図5参照)に当接するリング部302と、(4) このリング部302で囲まれた内側領域であって、上方に開口するリング状溝部3022と、(5) 管部303の下方に雄ねじ3051が周設され、ノズルボディ2bの下方内周部に形成された雌ネジ部205(図5参照)に螺着する螺着部305と、

(6) この螺着部305の下方に周方向に凸設して設けられ、Oリング状のパッキン7が装着されるパッキン装着部304と、(7) このパッキン装着部304の更に下方に形成され、組立て時のスパナ把持部位となるスパナ把持部306と、から構成されている。

【0030】ここで、図4を参照すると、上記(3)で記載したリング部302には、ノズル1b内部の気体通路5b(後述、図5参照)に連通されて、上下に貫通形成された高速気流形成溝3021が複数形成されている。この高速気流形成溝3021は、ノズル1b中心方向X(図2参照)から放射状に(符号Pで示す)周方向に等間隔で形成されている。

【0031】高速気流形成溝3021は、気体通路領域308へ導入されて前方に進行してくる気体Tを、該高速気流形成溝3021で構成される狭小な通路に追いつ込んで整流するとともに高速化し、気体噴射口201bから吐出される高速気流Th(図6参照)を形成するという役割を有効に果たしている。

【0032】次に、リング部302の外形状状においては、液体通路部材3bがノズルボディ2b内部所定位置に挿着されたとき(図5に示す状態のとき)に、ノズルボディ2bの尖頭部207bの内壁2071bに対抗する先細り傾斜面3023を備えている。

【0033】この構成によって、気体通路5bを進行してきた気体Tは、リング部302に至ると、高速気流形成溝3021以外に前方に進むことができる隙間が閉塞されてしまうことから、必然的に狭小な高速気流形成溝3021を通過していくことになって、整流及び高速化されることになる。

【0034】また、リング部302の内側領域には、管部303よりも小口径の先端管部3031が突設されている。この先端管部3031は、この先端管部3031の周囲を取り囲むリング部内周壁3024とともに、上記リング状溝部3022を形成している。このリング状溝部3022は、高速気流形成溝3021を通過してきた高速気流Thを、更に前方の気体噴射口201bへ送り込む整流用の領域として作用する。

【0035】また、先端管部3031の最先端部分には、液体通路4bと連通して、液体Rを外部に吐出する液体噴出口301bが開口形成されているとともに、同最先端部外筒部分には、前方方向に先細りする傾斜尖頭部3032が形成されている。

【0036】この傾斜尖頭部3032は、この傾斜尖頭部3032と同方向に傾斜するように形成されている(ノズルボディ2bの)尖頭部内壁2071bとともに、リング状溝部3022を通過してきた高速気流Thを、先細り円錐状に前方に吐出させるための整流板として作用する。尚、傾斜尖頭部3032の傾斜角度は、上記した傾斜尖頭部310a(図1参照)の傾斜角度と同様であるので説明を割愛する。

【0037】以下、ここで、実施例であるノズル1bの内部構造について、図5に基づき説明する。ノズルボディ2b内部に中空領域を形成している内周壁208の下方内周部領域には、雌ネジ部205が形成されている。この雌ネジ部205に液体通路部材3bの下方外周に形成された雄ネジ部305が螺合することにより、ノズルボディ2bに対して液体通路部材3bは挿着されている。

【0038】この際、液体通路部材3bのパッキン装着部304に装着されたリング状のパッキン7は、ノズルボディ2bの下端内周に周方向に形成されたパッキン収納部208に収まって、高圧状態の気体Tが外部に漏れるのを防止している。

【0039】尚、図5に示す符号307は、液体通路部材3bに、液体ホース10(図8参照)が連結されたホース連結部材11(図8参照)の図示しない雄ネジ部分の挿入されるための孔であって、この孔307の内周には、ホース連結部材11の雄ネジ部が螺合する雌ネジ309が形成されている。

【0040】ここで、ノズルボディ2bの内周壁208と液体通路部材3bの管部305の外周壁308と、で囲まれた領域は、気体導入孔202から導入された気体Tが通過するための気体通路5bとなる。

【0041】即ち、気体Tは、この気体通路5bを通過して、前方へ向かい、上記した高速気流形成溝3021(図4参照)及びリング状溝部3022を通過する際に整流高速化される。そして、気体Tは、気体噴射口201bに臨むように配置された(先端管部3031の)液体噴出口301b外側領域に、リング状に開口している気体噴射口201bを通過する際に、更に高速化されるとともに先細り円錐状の呈をなす高速気流Thとして、吐出される。

【0042】以下、図6を参照して、ノズル1b外部に吐出された液体R及び高速気流Thの動態について、詳述する。まず、液体通路部材3b内部の液体通路4bを通過してきた液体Rは、液体噴出口301bからノズル前方に吐出される。この吐出された液体Rは、流体特有の性質である縮流現象によって、液体噴出口301bからやや下流側において、断面積最小の縮流領域Rsを形成する。

【0043】一方、液体噴出口301b外側にリング状に開口する気体噴射口201bから吐出される高速気流

Thは、吐出されてくる液体Rを囲む先細り円錐状に、上記縮流部Rs位置で焦点（断面積最小となる部分）Fを結ぶように、吐出される。

【0044】即ち、先細り円錐状に吐出された高速気流Thは、ノズル1bから真っ直ぐ前方に初速度 V_0 で吐出された場合において、流体の性質により自然に生じる縮流部よりも、さらに断面積最小、流速最大 V_m の縮流部（焦点F領域）を強制的に形成することになる。このため、該焦点F領域において、高速気流Thによる液体破砕力は極大となる。

【0045】従って、液体Rは、焦点F領域において、液柱Rp中心まで瞬間的に破砕され、超微粒化されることから、焦点F領域から下流側では液柱がほとんど残らない。例えば、図6に示す D_1 （風速 V_1 ）、 D_2 （風速 V_2 ）地点におけるそれぞれの噴霧面801、802においても、それぞれ良好な微粒化液体 R_{m1} 、 R_{m2} の噴霧が可能となる。即ち、ノズル1bから噴霧面8までの距離が小さい場合でも、良好な噴霧を行なうことができる。

【0046】図6の噴霧面8近傍に示した簡易な粒径分布グラフのように、本発明に係る微粒化ノズル1では、液柱Rp中心部に対応する噴霧面803でも、粒径を最小に抑えることができる（従来技術を示す図9の粒径分布グラフと比較参照）。

【0047】図7は、実施例である微粒化ノズル1bを使用して、液体（水を使用）の流量別に、液体の50%粒径を測定した結果をグラフにしたものである。グラフ中に示す符号 $A_1 \sim A_5$ は、水の流量別50%粒径ラインを示しており、 A_1 は300cc/min、 A_2 は200cc/min、 A_3 は100cc/min、 A_4 は50cc/min、 A_5 は30cc/minの水の流量にそれぞれ対応したラインとなっている。符号Bに示すラインは、ノズルに導入された気体（Air）の噴射圧力（kg/cm²）別の消費風量（Nl/min）を示している。

【0048】図7に示すグラフに示すように、特に、水の流量50cc/min、30cc/minの場合においては、Air噴射圧力5kg/cm²の条件で、50%粒径が5 μ m以下となる。また、本ノズル1bは、Air噴射圧力と水の流量を調整することによって、所望の粒径の微粒化液体Rmを得ることができるため、制御しやすいという特性を備えている。尚、本実験で使用したノズル1bの液体噴出口の内口径Wは $\phi 2, 0$ mm、気体噴射口の口径は、 $\phi 3, 0$ mmである。

【0049】以下、図8を参照して、微粒化ノズル1bを使用して液体Rを微粒化する場合において、液体R、気体Tのそれぞれを、ノズル1bに送り込む方法の実施形態について説明する。

【0050】まず、液体ホース10からホース連結部材11を介してノズル1bに送り込まれる微粒化対象の液

体Rは、液体タンク1004に、予め必要量貯めておく。そして、液体Rは、該タンク1004からストレーナ1003で濾過した後、液送ポンプ1002による圧力によって、液体送量調整バルブ（オリフィス又は電磁バルブなど）1001で送量調整を行い、ノズル1bへ送り込む。尚、符号1005は、液体送量調整過程で、余分な液体Rを再び液体タンク1004に戻す返送管を示している。

【0051】一方、液体を微粒化するための気体Tは、エアーコンプレッサ903から吐出直後に、装置904において、ストレーナSで粉塵が除去されるとともに、ドライヤーDによって湿気が除去され、オンオフバルブ902及び圧力微調整用バルブ901を経て、気体送通管9が連結される（ノズル1bの）気体導入孔202からノズル1b内部へ送り込まれる。

【0052】尚、液体R、気体Tのそれぞれを、ノズル1bに送り込む方法は、上記実施形態に限定するものではなく、液体タンク1004をエアーコンプレッサ903から導入される気体で加圧し、圧力調整弁を介して液体をノズル1bに送り込む、タンク加圧方式等も採用し得る。

【0053】

【発明の効果】本願によって開示される発明が奏する効果を列記すれば、以下の通りである。

（1）請求項1に係る微粒化ノズルでは、ノズルの内部に導入された気体を外部に高速気流として噴出して、前記ノズルから吐出される液体を外部混合により微粒化する微粒化ノズルから高速気流を、ノズルに設けられた気体噴射口の前方位置に焦点を結ぶ先細り円錐状に前記気体噴射口から吐出する構成とすることで、前記ノズルに形成された液体噴出口から吐出されてくる液体を、液柱を残さずに、前記焦点位置で前記高速気流により瞬間的に粉碎し、微粒化することができるので、精密かつ安定した微粒化を達成できる。

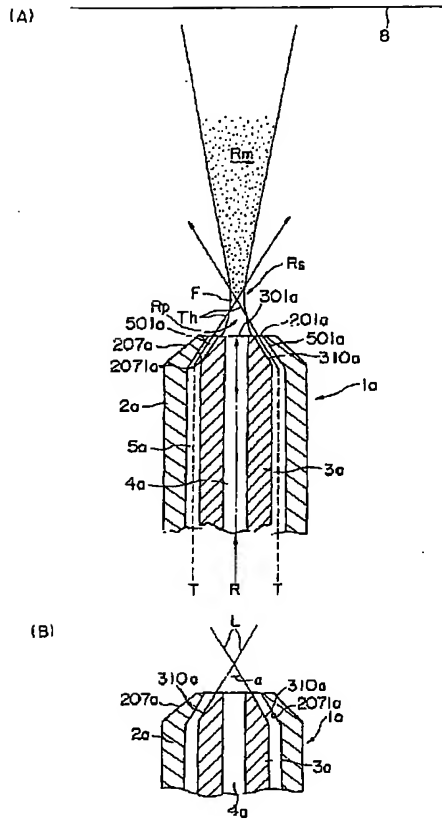
【0054】（2）請求項2に係る微粒化ノズルでは、微粒化ノズルを、所定形状の中空の「ノズルボディ」と該ノズルボディに挿着される「液体通路部材」の二つの部材からなる極めて簡易な構成とするこちによって、気体噴射口の前方位置に焦点を結ぶ先細り円錐状の高速気流を形成することもできて便利であり、ノズル設計も容易である。

【0055】（3）請求項3に係る微粒化ノズルでは、ノズルボディの尖頭部内壁を、気体吐出方向に先細りするように形成されるとともに、ノズルボディの気体噴射口に臨む液体噴出口の先端部外周壁部分を、液体吐出方向に先細りするように形成することによって（傾斜尖頭部を形成することによって）、ノズルボディ尖頭部内壁と液体噴出口の先端部外周壁を、先細り高速気流形成用の整流板として作用させ、確実に気体噴射口の前方位置に焦点を結ぶ先細り円錐状の高速気流を得ることがで

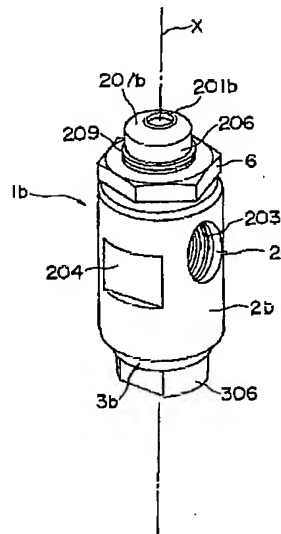
【図4】(A)同実施例の構成部品である液体通路部材の先端部分を拡大して示す斜視図

Th 高速气流

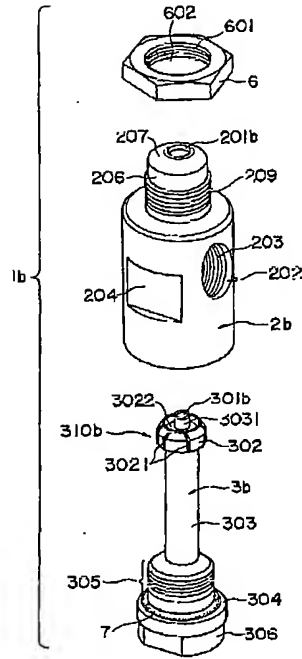
【図1】



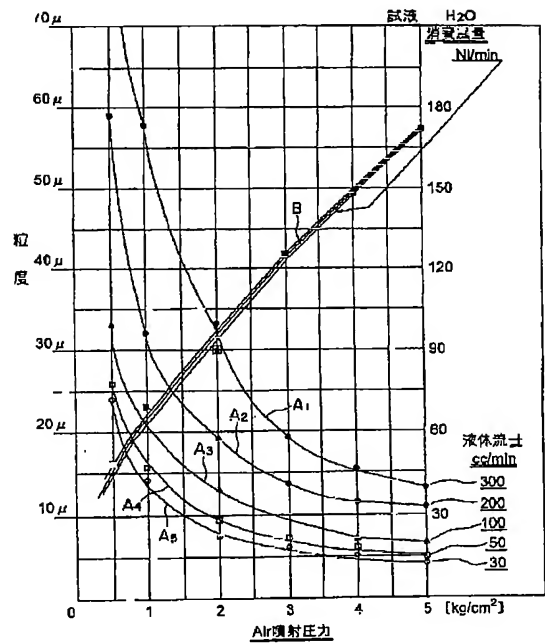
【図2】



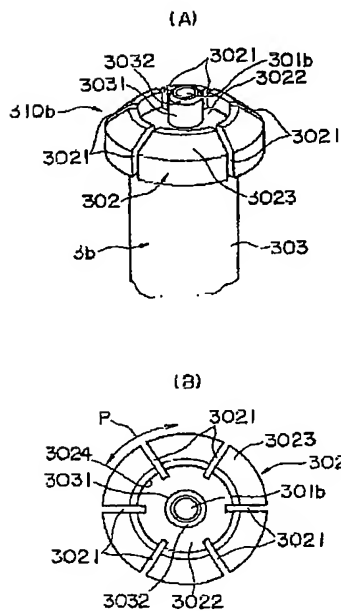
【図3】



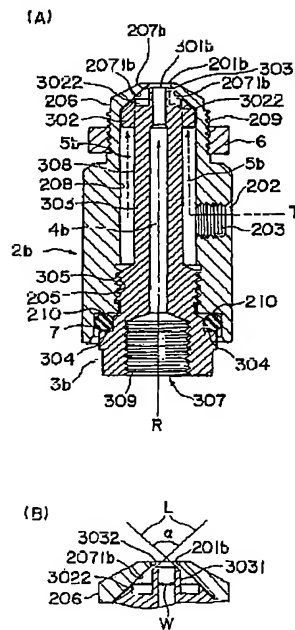
【図7】



【図4】



【図5】



PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-137747

(43)Date of publication of application : 22.05.2001

(51)Int.Cl.

B05B 7/08

B05B 1/26

(21)Application number : 11-326661

(71)Applicant : MATO KIMITOSHI

(22)Date of filing : 17.11.1999

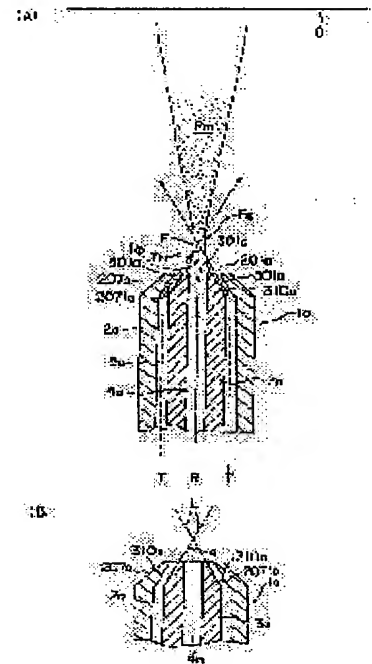
(72)Inventor : MATO KIMITOSHI

(54) ATOMIZING NOZZLE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an atomizing nozzle with excellent atomization characteristics and an extremely simple structure.

SOLUTION: In a nozzle 1 (1a or 1b) for atomization which jets outward gas T introduced into the nozzle as a high speed gas flow Th and atomizes a liquid R discharged from the nozzle 1 (1a or 1b) by mixing outside, the high speed gas flow Th is jetted from a gas jetting hole 201 (201a or 201b) into a tapering-off conical shape being brought to a focus F at a front position of the gas jetting hole 201 (201a or 201b) provided on the nozzle 1 (1a or 1b) and the liquid R discharged from a liquid jetting hole 301 (301a or 301b) formed on the nozzle 1 (1a or 1b) is instantaneously smashed and atomized to range over the center of the liquid column in the focus position F region by the high speed gas flow Th.



LEGAL STATUS

[Date of request for examination]

13.10.2005

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] By injecting the gas introduced into the interior of this nozzle body as a high-speed flow, while carrying out the regurgitation of the liquid introduced into the interior of a nozzle body In the nozzle which atomizes said liquid by external mixing said high-speed flow It is the configuration injected from said gas injection tip in the shape of [which connects a focus to the front location of a gas injection tip established in said nozzle body] a tapering cone. In said focal field The atomization nozzle characterized by grinding and atomizing the liquid which blows off from the liquid exhaust nozzle prepared inside said gas injection tip, and forms a liquid column until it reaches by said high-speed flow centering on said liquid column.

[Claim 2] The gas inlet where said nozzle introduces a gas into the interior of a nozzle, and said gas injection tip which injects outside the gas introduced from this gas inlet, Said nozzle body of a preparation ***** configuration, and liquid path tubing which forms the passage way of the liquid introduced into the interior of a nozzle, The liquid exhaust nozzle arranged so that opening may be carried out to the point of this liquid path tubing and said gas injection tip may be attended, While being the core's member inserted in the interior of a preparation and said nozzle body and forming said gas inlet and said gas injection tip, and a gas path field open for free passage in said nozzle body inside The atomization nozzle according to claim 1 characterized by having collaborated with this acumination part wall in the inside field of the tapering acumination part of said nozzle body, and having the liquid path member which forms the high-speed flow injected toward said focus from said gas injection tip.

[Claim 3] The peripheral wall of the point of said liquid exhaust nozzle which attends said gas injection tip while said acumination part wall of said nozzle body is formed so that it may taper off in the direction of the downstream is a atomization nozzle according to claim 2 characterized by being formed so that it may taper off in the direction of the downstream.

[Claim 4] Said liquid exhaust nozzle of said liquid path member a little in a lower part location The ring section which contacts the acumination part wall of said nozzle body is formed. In this ring section The high-speed flow formation slot for forming the high-speed flow which is made to pass the air which has advanced said gas path field, carries out rectification improvement in the speed, and is breathed out from said gas injection tip It is the atomization nozzle according to claim 3 characterized by being the configuration by which two or more formation was carried out at hoop direction regular intervals, and forming said high-speed flow formation slot in a radial from a nozzle core.

[Claim 5] The atomization nozzle characterized by what was indicated by either of claims 1-4 characterized by the ability to form a liquid particle with a particle size of 5 micrometers or less when the inner aperture of said liquid exhaust nozzle is formed in the diameter of 2mm or more.

[Translation done.]

* NOTICES *

JPO and INPIT are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] About the nozzle which atomizes a liquid by the external mixing method, further, this invention is crushed to the core of said liquid column by the tapering conic high-speed flow which is breathed out from a nozzle in the liquid which is breathed out by the detail from a nozzle and forms a liquid column, and connects a focus to a nozzle front location, and relates to the nozzle to atomize.

[0002]

[Description of the Prior Art] The atomization nozzles which atomize and carry out the spraying regurgitation of the liquid are various industrial fields, such as a humidification activity of paint, granulation, combustion, cover coat blasting in a ceramic industry, paper manufacture, and a fiber production process, and thin film precision coating, and are used.

[0003] It explains with reference to drawing 9 which simplifies and shows the typical conventional technique. While carrying out the regurgitation of the liquid r ahead [of a nozzle 20] from the liquid delivery 13 of the liquid path tubing 19 arranged to the central field of the nozzle body 18 interior To the periphery field of this discharged liquid object r_1 by the configuration which carries out the regurgitation of the air current t introduced into the gas path 16 formed in the nozzle 20 interior ahead from the gas injection tip 12 formed in the acumination part 14 of a nozzle body 18 There is a atomization nozzle 20 of the external mixing method which changes Liquid r into the atomization liquid rm .

[0004]

[Problem(s) to be Solved by the Invention] However, with the above-mentioned conventional technique, the initial velocity v_0 of the air current immediately after breathing out ahead [nozzle 20] from a nozzle 20 serves as a distributed inclination as it goes ahead (downstream), and it will also decrease the wind speed rapidly with the increment in the air-current cross section (refer to the graph which shows wind-speed change of drawing 9 simply). ($v_0 \rightarrow v_1 \rightarrow v_2$) For this reason, the force which crushes the liquid of the regurgitation air current th will become weaker quickly, and will go.

[0005] Moreover, with the nozzle 20, since the configuration of the gas exhaust nozzle 15 is formed in the shape of a straight line as a sign 15 shows, the liquid r breathed out from a nozzle 20 has the composition of being atomized gradually, in the liquid r of the nozzle 20 front, and the boundary layer L of an air current th . For this reason, ahead of a nozzle 20, the liquid column (liquid part which is not atomized) r_1 of predetermined length will be left.

[0006] Consequently, when the spraying side 17 is located in the location shown with signs d_1 and d_2 from the tip of a nozzle 20, it sets. Even if it is the case where considerable-amount spraying of the liquids r_2 and r_4 inadequate for a part for the core of the sprayed atomization liquids r_3 and r_5 in atomization by existence of a liquid column r_1 will be carried out, and the spraying side 17 is in predetermined distance As shown in the graph of the particle size distribution on the left-hand side of drawing 9, the fault that a liquid with a big particle size will be sprayed in the center of a spraying field occurred, and the technical technical problem that a precision and advanced atomization could not be attained occurred.

[0007] In addition, in order to avoid the effect by the liquid column r_1 as much as possible and to attain desired liquid atomization, it learned, if aperture of the liquid exhaust nozzle 13 was not made as small as possible, and there was also an unescapable limit on a ***** nozzle design. In order to atomize water in mean particle diameter of about 5 micrometers, specifically, inner aperture w of the fluid injection opening 13 had to be set to about 0.3-0.5mm.

[0008] Thus, in the case where it is the nozzle as which the design which makes small inner aperture of the fluid injection opening 13 was adopted, there were many limits a lifting and on an activity since a bigger pressure needs to become empty and spout with a bigger liquid than that of viscosity about blinding, and it was inconvenient.

[0009] on the other hand, the advanced engine performance in which the ultrafine particle of a desired particle size can be obtained to a precision and homogeneity requires of a atomization nozzle in recent years -- having -- especially -- recent years -- growth -- in fields, such as thin film precision coating of a remarkable magnetic disk, and a semi-conductor manufacture, the precision prescribe is still higher.

[0010] Then, the purpose of this invention is very simple structure, and is to offer the atomization nozzle excellent in characteristics of atomization.

[0011]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, while carrying out the regurgitation of the liquid introduced into the interior of a nozzle body, by claim 1, the following means are adopted in the nozzle which atomizes said liquid by external mixing by injecting the gas introduced into the interior of this nozzle body as a high-speed flow. As a configuration injected from said gas injection tip in the shape of [which connects a focus to the front location of a gas injection tip in which said high-speed flow was prepared by said nozzle body] a tapering cone, namely, in said focal field With this means to grind and to atomize the liquid which blows off from the liquid exhaust nozzle prepared inside said gas injection tip, and forms a liquid column until it reaches the core of said liquid column by said high-speed flow Since the high-speed flow by which the injection regurgitation is carried out from the gas injection tip of a atomization nozzle is constituted so that it may be injected in the shape of [which connects a focus to the location close to this gas injection tip] a tapering cone, the crushing force of an air current concentrates in said focal field, and a liquid will be momentarily crushed by homogeneity and will be super-atomized. That is, since it considers as the condition that the high-speed flow which blows off from the gas injection tip of a atomization nozzle is the focal field formed in the downstream which is a little separated from a gas injection tip, and a "contracted vein" is compulsorily carried out more and the cross section of a high-speed flow is made smaller than the area of a gas injection tip, the

rate of flow serves as max in this focal location, and the strong crushing force is acquired. In addition, a fluid serves as a jet from the small hole opened in the wall of an orifice or a container, and when carrying out the regurgitation of the "contracted vein", it means the phenomenon in which the cross section of a jet becomes smaller than the area of a discharge part in the downstream location which separated a few from the delivery.

[0012] At claim 2, said nozzle consists of two members (1) formed with another object, and (2). The gas inlet which specifically introduces a gas into the interior of (1) nozzle, and said gas injection tip which injects outside the gas introduced from this gas inlet. The above "a nozzle body" of a preparation ***** configuration, and liquid path tubing which forms the passage way of the liquid introduced into the interior of (2) nozzles, The liquid exhaust nozzle arranged so that opening may be carried out to the point of this liquid path tubing and said gas injection tip may be attended, While being the core's member inserted in the interior of a preparation and said nozzle body and forming said gas inlet and said gas injection tip, and a gas path field open for free passage in said nozzle body inside It is the "liquid path member" which forms the high-speed flow which collaborates with this acumination part wall in the inside field of the tapering acumination part of said nozzle body, and is injected toward said focus from said gas injection tip. With this means, also by the simple configuration which consists of the core's liquid path member and two members of ** in which a atomization nozzle is inserted by a nozzle body and this nozzle body in the air, the tapering conic high-speed flow which connects a focus to the front location of a gas injection tip can form so that the liquid column core of the breathed-out liquid may be reached.

[0013] In claim 3, in a atomization nozzle according to claim 2, the point peripheral wall of the liquid exhaust nozzle which faces the acumination part wall of a nozzle body the gas injection tip of a nozzle body while being formed so that it may taper off in the direction of the downstream is formed so that it may taper off in the direction of the downstream. With this means, by making the nozzle body acumination part wall and the point peripheral wall of a liquid exhaust nozzle which taper off in the direction of the downstream (gas (liquid) discharge direction) act as a straightening vane, the gas which goes straight on the gas path field according to claim 2 formed in the interior of a nozzle body is changed into the tapering conic air current which connects a focus to the front location of a gas injection tip, and carries out the injection regurgitation from a gas injection tip.

[0014] In claim 4, two or more high-speed flow formation slots for forming the high-speed flow which forms the ring section of the liquid exhaust nozzle of a liquid path member which contacts the acumination part wall of a nozzle body a little at a lower part location part, is made to pass the gas which has advanced the gas path field in this ring section, and carries out rectification improvement in the speed and which carries out the regurgitation from a gas injection tip are formed from a nozzle core in a atomization nozzle according to claim 3 at a radial at hoop direction regular intervals. With this means, the high-speed flow formation slot formed in the arrangement ring section in contact with the acumination part wall of a nozzle body demonstrates the operation which rectifies in the direction of the front while it drives into a narrow path the air current which has advanced the gas path field and accelerates an air current, so that a plug may be carried out ahead [of a gas path field].

[0015] In claim 5, when the inner aperture of the liquid exhaust nozzle indicated by either of claims 1-4 is formed in the diameter of 2mm or more, a liquid particle with a particle size of 5 micrometers or less can be formed. With this means, since the inner aperture of a liquid exhaust nozzle can be designed greatly, even if it is a liquid with large viscosity, it not only can prevent blinding, but it becomes possible to carry out the regurgitation with low voltage.

[0016] Though this invention is a simple configuration by adopting the above means, the atomization nozzle excellent in characteristics of atomization can be offered. That is, since the atomization nozzle concerning this invention is a simple configuration, it has the meaning on the technique in which a more precise liquid atomization technique can be offered now which is easy to carry out adjustable [of the size of a nozzle], and is useful to various industrial fields in respect of the increase in efficiency and automation of a production process, improvement in a product, etc. since atomization adjustment is also easy.

[0017]

[Embodiment of the Invention] Next, the suitable operation gestalt of this invention is explained, referring to an accompanying drawing. Drawing 1 (A) the sectional view and this drawing (B) which simplify and express the important section of the suitable operation gestalt of the atomization nozzle concerning this invention The expanded sectional view of the acumination part of this atomization nozzle and drawing 2 The perspective view and drawing 3 which show the appearance configuration of the example of this nozzle Drawing 4 (A) which disassemble and show the component part of this example The perspective view expanding and showing a part for the point of the liquid path member which is the component part of this example, and (B) The top view and drawing 5 (A) which looked at a part for this point from right above Drawing 6 of longitudinal section and this drawing (B) showing the internal configuration of this example Drawing 7 to which the expanded sectional view of the acumination part of this example and drawing 8 express simply the atomization-of-liquid condition by this example drawing simplifying and showing an operation gestalt in case drawing which expressed with the graph the result of having used the atomization nozzle which is an example and having measured 50% particle size according to liquid flow rate, and drawing 9 send each of Liquid R and Gas T into nozzle 1b -- it comes out.

[0018] First, with reference to drawing 1, the important section configuration of atomization nozzle 1a which is the suitable operation gestalt of this invention is simplified and explained. Nozzle body 2a of the hollow which atomization nozzle 1a equips a point with (1) gas injection-tip 201a, and constitutes the nozzle outer case section, (2) Liquid path member 3a inserted in the interior of said nozzle body 2a so that a point may be equipped with liquid exhaust nozzle 301a which is open for free passage to the liquid path shown in sign 4a and said gas injection-tip 201a may be faced this liquid exhaust nozzle 301a, since -- the path (it is called a "gas path" below.) Of Gas T where building envelope 5a which is constituted and is formed of nozzle body 2a and liquid path member 3a is introduced into nozzle 1a It has become.

[0019] Acumination part 207 of nozzle body 2a tapers off in the direction of the front (downstream), and is made into the configuration. It is formed of the skin of acumination part 310a of acumination part wall 2071 of this acumination part 207a a, and liquid path member 3a, and the aperture of gas discharge passage 501a which inclined towards the center of a slanting front nozzle is designed smaller than the aperture of gas path 5a.

[0020] For this reason, it turns the gas T which has gone gas path 5a straight on while being accelerated in the process in which narrow gas discharge passage 501a is passed, and it forms the high-speed flow Th which tapers off ahead [nozzle 1a] and is breathed out by the cone configuration.

[0021] From the inside field of this high-speed flow Th, Liquid R is breathed out by the predetermined flow rate from liquid exhaust nozzle 301a. This breathed-out liquid R is the location of the downstream which separated a few from liquid exhaust nozzle 301a, and forms the vena contracta Rs of cross-section min with a property peculiar to a fluid.

[0022] The above-mentioned high-speed flow Th forms the focus F which constitutes the cross-section minimum and wind-speed greatest vena contracta so that it may lap with this vena-contracta Rs field. A high-speed flow Th crushes Liquid R

momentarily in this focal F location, and enables it to spray the atomization liquid Rm on the desired spraying side 8 by this.

[0023] In this focal F location, since the wind speed of a high-speed flow Th serves as max, in the boundary layer of Liquid R and a high-speed flow Th, the liquid crushing force serves as the maximum and the super-atomization of Liquid R will be attained efficiently and certainly. That is, since a high-speed flow Th reaches even the core of the liquid column Rp which the liquid R breathed out from nozzle 1a forms and is crushed, it can stop the liquid R which is not crushed to the minimum.

[0024] Here, as for whenever [tilt-angle / of inclination acumination part 310 of liquid path member 3a which forms liquid exhaust nozzle 301a a], it is desirable to design so that the include angle alpha when the front production L (refer to drawing 1 (B)) crosses may become 60 degrees - 90 degrees. This is because the atomization effectiveness that whenever [spray angle / of a high-speed flow Th] asks also for obtuse angle past ** and acute-angle past ** is hard to be acquired.

[0025] Hereafter, with reference to drawing 2, the configuration of the concrete example of the atomization nozzle concerning this invention is explained. first, liquid path member 3b which the appearance of nozzle 1b which is this example is inserted [b] in a part for the centrum of nozzle body 2b of the hollow which constitutes the cylindrical shape-like nozzle outer case section, and this nozzle body 2b, and is exposing the nut section 306 in the nozzle body 2b lower limit section -- since -- it is constituted.

[0026] Here, nozzle body 2b consists of parts of an exterior and following (1) - (5). It is formed in the front end section of (1) this nozzle body 2b. Male screw 209 into the periphery part Namely, the formed thin cylinder part 206, (2) Tapering acumination part 207b which was formed at the tip of this thin cylinder part 206 and which inclines in the direction of nozzle core X, (3) Gas injection-tip 201b which carries out opening at the tip of this acumination part 207b, (4) -- the gas inlet 202 which ***** is formed perpendicularly, and a female screw 203 is formed in the inner skin, and opens the periphery part of this body 2b for free passage to gas injection-tip 201b, and the concave flat part 204 of the pair by which opposite formation was carried out at the periphery part of (5) nozzle-body 2b -- since -- it is constituted.

[0027] In addition, the hexagon nut 6 with which the male screw section 601 is equipped with the hole 602 formed in the inner circumference section is screwed on the male screw 209 section of said thin cylinder part 206. moreover, the above-mentioned concave flat part 204 -- nozzle 1b -- grasping members, such as a spanner, -- inserting -- an edge strip -- fixing -- easy -- carrying out -- easy-izing the assembly of a nozzle **** -- etc. -- it is the prepared part in order to carry out.

[0028] Drawing 3 decomposes and shows the member which constitutes this nozzle 1b. liquid path member 3b of the core who the above-mentioned nozzle 1b is inserted in nozzle body 2b mentioned above, the nut 6 (****) screwed on the thin cylinder part 206 of this nozzle body 1b, and the interior of nozzle body 1b, and forms the path of the liquid R for atomization, and the packing 7 for gas sealing (O ring) -- since -- it is constituted.

[0029] Here, the appearance configuration of liquid path member 3b is explained based on drawing 3 and drawing 4. First, liquid path member 3b consists of following (1) - (7). Namely, the tube part 303 of the shape of a cylinder which equips (1) inside with path 4b (refer to drawing 5) of Liquid R, (2) Liquid exhaust nozzle 301b which opening formation is carried out at the upper limit of this tube part 303, and carries out the regurgitation of the liquid R outside, (3) -- point ** of a tube part 303 -- with the ring section 302 which protrudes on a hoop direction in the shape of a ring, and contacts lower part partial 310b a little at acumination part wall 2071b (refer to drawing 5) of said nozzle body 2b (4) The ring-like slot 3022 which is the inside field surrounded in this ring section 302, and carries out opening to the upper part, (5) The screwing section 305 screwed on the female screw section 205 (refer to drawing 5) which the male screw 3051 was attached under the tube part 303, and was formed in the lower part inner circumference section of nozzle body 2b, (6) -- the packing applied part 304 which it is protruded and prepared in a hoop direction under this screwing section 305, and is equipped with the O ring-like packing 7, and (7) -- the spanner grasping section 306 which this packing applied part 304 is formed further caudad, and serves as a spanner grasping part at the time of an assembly -- since -- it is constituted.

[0030] Here, if drawing 4 is referred to, gas path 5b inside nozzle 1b (refer to the after-mentioned and drawing 5) is open for free passage, and two or more formation of the high-speed flow formation slot 3021 by which penetration formation was carried out up and down is carried out at the ring section 302 indicated above (3). This high-speed flow formation slot 3021 is formed [X] in the hoop direction (Sign P shows) at equal intervals from the nozzle 1b core at the radial (refer to drawing 2).

[0031] The high-speed flow formation slot 3021 was accelerated while driving the gas T which is introduced to the gas path field 308 and advances ahead into the narrow path which consists of these high-speed flow formation slots 3021 and rectifying, and the role of forming the high-speed flow Th (referring to drawing 6) breathed out from gas injection-tip 201b is played effectively.

[0032] Next, in the appearance configuration of the ring section 302, when liquid path member 3b is inserted in an interior of nozzle body 2b predetermined location (at the time of the condition which shows in drawing 5), it has the tapering inclined plane 3023 which opposes wall 2071 of acumination part 207b of nozzle body 2b b.

[0033] When the gas T which has advanced gas path 5b results in the ring section 302, in addition to high-speed flow formation slot 3021, from the clearance which can progress ahead being blockaded, it will pass through the narrow high-speed flow formation slot 3021 inevitably, and will be rectified and accelerated by this configuration.

[0034] Moreover, the tip tube part 3031 of small aperture protrudes on the inside field of the ring section 302 rather than the tube part 303. This tip tube part 3031 forms the above-mentioned ring-like slot 3022 with the ring section inner circle wall 3024 which encloses the perimeter of this tip tube part 3031. This ring-like slot 3022 acts as a field for rectification which sends further into front gas injection-tip 201b the high-speed flow Th which has passed through the high-speed flow formation slot 3021.

[0035] Moreover, it is open for free passage with liquid path 4b, and while opening formation of the liquid exhaust nozzle 301b which carries out the regurgitation of the liquid R outside is carried out, the inclination acumination part 3032 which tapers off in the direction of the front is formed in the latest section outer case part of this at the latest part of the tip tube part 3031.

[0036] This inclination acumination part 3032 acts as a straightening vane for making the high-speed flow Th which has passed through the ring-like slot 3022 with acumination part wall 2071b in which it is formed so that it may incline in this inclination acumination part 3032 and this direction (nozzle body 2b) breathe out ahead in the shape of a tapering cone. In addition, since it is the same as that of whenever [tilt-angle / of the above-mentioned inclination acumination part 310a (refer to drawing 1)], whenever [tilt-angle / of the inclination acumination part 3032] omits explanation.

[0037] Hereafter, here explains the internal structure of nozzle 1b which is an example based on drawing 5. The female screw section 205 is formed in the lower part inner circumference section field of the inner circle wall 208 which forms the hollow field in the interior of nozzle body 2b. When the male screw section 305 formed in this female screw section 205 at the lower part periphery of liquid path member 3b screws, liquid path member 3b is inserted to nozzle body 2b.

[0038] Under the present circumstances, the ring-like packing 7 with which the packing applied part 304 of liquid path member 3b was equipped has prevented that fit in the packing stowage 208 formed in the hoop direction at the lower limit inner circumference of nozzle body 2b, and the gas T of a high-pressure condition leaks outside.

[0039] In addition, the sign 307 shown in drawing 5 is a hole to insert the male screw part which the hose connection member 11 (refer to drawing 8) by which the liquid hose 10 (refer to drawing 8) was connected with liquid path member 3b does not illustrate, and the female screw 309 which the male screw section of the hose connection member 11 screws is formed in the inner circumference of this hole 307.

[0040] here, the inner circle wall 208 of nozzle body 2b, the peripheral wall 308 of the tube part 305 of liquid path member 3b, and the field come out of and surrounded are set to gas path 5b for the gas T introduced from the gas installation hole 202 to pass.

[0041] That is, Gas T passes along this gas path 5b, and in case it passes through the above-mentioned high-speed flow formation slot 3021 (refer to drawing 4) and the above-mentioned ring-like slot 3022 toward the front, rectification improvement in the speed of it is carried out. And Gas T is breathed out as a high-speed flow Th which tapers off while being further accelerated to it, in case gas injection-tip 201b which is carrying out opening to the shape of a ring is passed to the liquid exhaust nozzle 301b outside field (tip tube part 3031) arranged so that gas injection-tip 201b may be attended, and makes conic **.

[0042] Hereafter, with reference to drawing 6, the moving state of the liquid R breathed out by the nozzle 1b exterior and a high-speed flow Th is explained in full detail. First, the liquid R which has passed liquid path 4b inside liquid path member 3b is breathed out ahead [nozzle] from liquid exhaust nozzle 301b. This breathed-out liquid R forms the contracted-vein field Rs of cross-section min in the downstream according to the contracted-vein phenomenon which is a property peculiar to a fluid a little from liquid exhaust nozzle 301b.

[0043] In the shape of [surrounding the liquid R breathed out] a tapering cone, the high-speed flow Th breathed out by the liquid exhaust nozzle 301b outside on the other hand from gas injection-tip 201b which carries out opening to the shape of a ring is breathed out so that Focus (part used as cross-section min) F may be connected with the above-mentioned vena-contracta Rs location.

[0044] namely, the vena contracta automatically produced with the property of a fluid when the high-speed flow Th breathed out in the shape of a tapering cone is breathed out at initial velocity V0 ahead [straight] from nozzle 1b -- further -- cross-section min and the rate-of-flow max -- the vena contracta (focal F region) of Vm will be formed compulsorily. For this reason, in this focal F region, the liquid crushing force by the high-speed flow Th serves as the maximum.

[0045] Therefore, Liquid R is momentarily crushed to a liquid column Rp core in a focal F region, and since it is super-atomized, by the downstream, a liquid column hardly remains from a focal F region. For example, even if each in D1 (wind speed V1) and D2 (wind speed V2) point which are shown in drawing 6 sets spraying side 801,802, spraying of the respectively good atomization liquids Rm1 and Rm2 is attained. That is, good spraying can be performed even when the distance from nozzle 1b to the spraying side 8 is small.

[0046] Like the simple particle-size-distribution graph shown in about eight spraying side of drawing 6, particle size can be held down to min with the atomization nozzle 1 concerning this invention also in respect of [803] spraying corresponding to a liquid column Rp core (refer to the particle-size-distribution graph of drawing 9 and comparison which show the conventional technique).

[0047] Drawing 7 uses atomization nozzle 1b which is an example, and makes a graph the result of having measured 50% particle size of a liquid according to the flow rate of a liquid (water is used). The sign A1 shown in a graph -- A5 show 50% particle-size Rhine classified by flow rate of water, and A1 has become 300 cc/min and Rhine respectively corresponding to [2 / A / A3 / 200 cc/min and / corresponding to 50 cc/min in 100 cc/min and A4] the flow rate of the water of 30 cc/min in A5. the injection pressure (kg/cm2) of the gas (Air) with which Rhine shown in Sign B was introduced into the nozzle -- another consumption airflow (NI/min) is shown.

[0048] As shown in the graph shown in drawing 7, especially, in flow rate 50 cc/min of water, and 30 cc/min, it is the conditions of 5kg/cm2 of Air injection pressures, and particle size is set to 5 micrometers or less 50%. Moreover, since this nozzle 1b can obtain the atomization liquid Rm of a desired particle size by adjusting the flow rate of an Air injection pressure and water, it is equipped with the property of being easy to control. In addition, the aperture of phi 2.0mm, and a gas injection tip of the inner aperture W of the liquid exhaust nozzle of nozzle 1b used in this experiment is phi3.0mm.

[0049] Hereafter, when atomizing Liquid R with reference to drawing 8 using atomization nozzle 1b, the operation gestalt of the approach of sending each of Liquid R and Gas T into nozzle 1b is explained.

[0050] First, the liquid R for [which is sent into nozzle 1b through the hose connection member 11 from the liquid hose 10] atomization is initial-complement ***** beforehand to the liquid tank 1004. And after filtering Liquid R with a strainer 1003 from this tank 1004, with the pressure by the liquid transport pump 1002, it performs feed-ratio adjustment with the liquid feed-ratio modulating valves (an orifice or electro-magnetic valve) 1001, and sends it into nozzle 1b. In addition, a sign 1005 is like a liquid feed-ratio adjustment fault, and return tubing which returns the excessive liquid R to the liquid tank 1004 again is shown.

[0051] On the other hand, moisture is removed by Dryer D and the gas T for atomizing a liquid is sent into the interior of nozzle 1b through the on-off bulb 902 and the bulb 901 for pressure fine tuning from the gas installation hole (nozzle 1b) 202 with which gas ***** is connected while dust is removed from an air compressor 903 by Strainer S in equipment 904 just behind the regurgitation.

[0052] In addition, the approach of sending each of Liquid R and Gas T into nozzle 1b is not limited to the above-mentioned operation gestalt, and pressurizes the liquid tank 1004 with the gas introduced from an air compressor 903, and the tank pressurization method which sends a liquid into nozzle 1b through a pressure regulating valve can be used for it.

[0053]

[Effect of the Invention] It will be as follows if the effectiveness that invention indicated by this application does so is listed.

(1) Blow off the gas introduced into the interior of a nozzle as a high-speed flow outside with the atomization nozzle concerning claim 1. By considering as the configuration which carries out the regurgitation to the shape of a tapering cone which connects a focus to the front location of a gas injection tip in which the high-speed flow was prepared by the nozzle from said gas injection tip from the atomization nozzle which atomizes the liquid breathed out from said nozzle by external mixing Since said high-speed flow can grind momentarily the liquid breathed out from the liquid exhaust nozzle formed in said nozzle and it can be atomized in said focal location, without leaving a liquid column, a precision and the stable atomization can be attained.

[0054] (2) The tapering conic high-speed flow which connects a focus with the atomization nozzle concerning claim 2 to the

front location of a gas injection tip by **** which considers a atomization nozzle as the very simple configuration which consists of two members of the "liquid path member" in which it is inserted by the "nozzle body" and this nozzle body of a predetermined configuration in the air can also be formed, it is convenient, and a nozzle design is also easy.

[0055] (3) With the atomization nozzle concerning claim 3, while being formed so that it may taper off to a gas discharge direction, the acumination part wall of a nozzle body A part for the point periphery wall of the liquid exhaust nozzle which attends the gas injection tip of a nozzle body By forming so that it may taper off to a liquid discharge direction (an inclination acumination part is formed) A nozzle body acumination part wall and the point peripheral wall of a liquid exhaust nozzle can be made to be able to act as a straightening vane for tapering high-speed flow formation, the tapering conic high-speed flow which connects a focus to the front location of a gas injection tip certainly can be obtained, and it contributes to improvement in the atomization engine performance of a nozzle.

[0056] (4) Set for a atomization nozzle according to claim 3 with the atomization nozzle concerning claim 4. The ring section which contacts the acumination part wall of a nozzle body is formed in the lower part location part of the liquid exhaust nozzle of a liquid path member. In this ring section By forming in hoop direction regular intervals two or more high-speed flow formation slots for forming the high-speed flow which is made to pass the gas which has advanced the gas path field, and carries out rectification improvement in the speed and which carries out the regurgitation from a gas injection tip, and forming them in a radial from a nozzle core The high-speed flow formation slot formed in the ring section drives into a narrow path the air current which has advanced the gas path field. While accelerating an air current, in order to demonstrate effectively the operation which rectifies in the direction of the front, desired ***** can be obtained stably and it contributes to improvement in the atomization engine performance of a nozzle.

[0057] (5) With the atomization nozzle concerning claim 5, since it has the outstanding property that a liquid particle with a particle size of 5 micrometers or less can be formed when the inner aperture of a liquid exhaust nozzle is formed in the diameter of 2mm or more, the inner aperture of a liquid exhaust nozzle is designed greatly, and even if it not only can prevent blinding, but is a liquid with large viscosity, the regurgitation can be carried out with low voltage.

[0058] (6) As mentioned above, though it is a very simple configuration, since this invention can offer the atomization nozzle excellent in characteristics of atomization, it can offer the more precise liquid atomization technique which is useful in respect of the increase in efficiency and automation of a production process, improvement in a product, etc. to various industrial fields.

[Translation done.]

* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.*** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] (A) The sectional view which simplifies and expresses the important section of the suitable operation gestalt of the atomization nozzle concerning this invention

(B) The expanded sectional view for a point of this atomization nozzle

[Drawing 2] The perspective view showing the appearance configuration of the example of this nozzle

[Drawing 3] Drawing disassembling and showing the component part of this example

[Drawing 4] (A) The perspective view expanding and showing a part for the point of the liquid path member which is the component part of this example

(B) The top view which looked at a part for this point from right above

[Drawing 5] (A) Drawing of longitudinal section showing the internal configuration of this example

(B) The expanded sectional view of the acumination part of this example, drawing of longitudinal section showing the internal configuration within this example

[Drawing 6] Drawing which expresses simply the atomization-of-liquid condition by this example

[Drawing 7] Drawing which expressed with the graph the result of having used the atomization nozzle which is an example and having measured 50% particle size according to liquid flow rate

[Drawing 8] Drawing simplifying and showing the operation gestalt in the case of sending each of Liquid R and Gas T into nozzle 1b

[Drawing 9] Drawing which expresses the configuration of the general conventional technique simply

[Description of Notations]

1 (1a, 1b) Atomization nozzle

2 (2a, 2b) Nozzle body

3 (3a, 3b) Liquid path member

4 (4a, 4b) Liquid path

5 (5a, 5b) Gas path

201 (201a, 201b) Gas injection tip

202 Gas Inlet

207 (207a, 207b) Tapering acumination part

301 (301a, 301b) Liquid exhaust nozzle

302 Ring Section

303 Liquid Path Tubing

2071 (2071a, 2071b) Acumination part wall

3021 High-speed Flow Formation Slot of Ring Section

3032 Inclination Acumination Part of Liquid Exhaust Nozzle

F Focus

R Liquid

Rm Atomization liquid

Rp Liquid column

Rs Vena contracta

T Gas

Th High-speed flow

[Translation done.]